

We claim:

- 1     1. A container comprising material made by a solid state method for the manufacture  
2     of foamed polymeric material, comprising the steps:
  - 3         (a) interleaving an article of raw polymeric material with a gas channeling  
4         means;
  - 5         (b) exposing the interleaved article at elevated pressure to a non-reacting gas  
6         which is soluble in the polymer for a time sufficient to achieve a desired concentration  
7         of gas within the polymer, thereby forming an exposed polymeric article which is at  
8         least partially gas-saturated;
  - 9         (c) decompressing the exposed polymeric article and separating the article  
10      from the gas channeling means;
  - 11      (d) foaming the exposed article at a temperature below the melt temperature of  
12      the polymeric material; and
  - 13      (e) trimming the foamed article to produce finished foamed polymeric material  
14      and scrap solid state process foamed polymer,  
15      wherein the raw polymeric material comprises up to 100% of any one of the  
16      group consisting of recycled pre-consumer polymer, recycled post-consumer polymer  
17      and scrap solid state process foamed polymer.

- 1     2. The container of claim 1, wherein said container has a round base.
- 1     3. The container of claim 1, wherein said container has a substantially rectangular  
2     base.
- 1     4. The container of claim 1, further comprising:
  - 2         (a) a bottom member,
  - 3         (b) concave upward bumps affixed on horizontal plane of said bottom  
4         member.
- 1     5. The container of claim 1, further comprising:
  - 2         (a) a bottom piece,
  - 3         (b) a top piece, and

4                   (c) a living hinge connecting said bottom piece to said top piece.

1       6. The container of claim 5, further comprising at least one handle.

1       7. The container of claim 5, further comprising a liner tray.

1       8. A container comprising material by made by a solid state method for the  
2       manufacture of foamed polymeric material, comprising the steps:

3                   (a) interleaving an article of raw polymeric material with a gas channeling  
4       means;

5                   (b) exposing the interleaved article at elevated pressure to a non-reacting gas  
6       which is soluble in the polymer for a time sufficient to achieve a desired concentration  
7       of gas within the polymer, thereby forming an exposed polymeric article which is at  
8       least partially gas-saturated;

9                   (c) decompressing the exposed polymeric article and separating the article  
10      from the gas channeling means;

11                  (d) foaming the exposed article at a temperature below the melt temperature of  
12      the polymeric material; and

13                  (e) trimming the foamed article to produce finished foamed polymeric material  
14      and scrap solid state process foamed polymer,

15                  wherein the foam has a relative density of 5 to 80%.

1       9. The container of claim 8, wherein said foam has an 8 to 35% relative density.

1       10. The container of claim 8, wherein said container has a round base.

1       11. The container of claim 8, wherein said container has a substantially rectangular  
2       base.

1       12. The container of claim 8, further comprising:

2                   (a) a bottom member,

3                   (b) concave upward bumps affixed on horizontal plane of said bottom  
4 member.

5

1       13. The container of claim 8, further comprising:

2                   (a) a bottom piece,

3                   (b) a top piece, and

4                   (c) a living hinge connecting said bottom piece to said top piece.

1       14. The container of claim 13, further comprising at least one handle.

1       15. The container of claim 13, further comprising a liner tray.

1       16. A container comprising material made by a solid state method for the manufacture  
2 of foamed polymeric material, comprising the steps:

3                   (a) interleaving an article of raw polymeric material with a gas channeling  
4 means;

5                   (b) exposing the interleaved article at elevated pressure to a plasticizing gas  
6 which is soluble in the polymer for a time sufficient to achieve a desired concentration  
7 of gas within the polymer, thereby forming an exposed polymeric article which is at  
8 least partially gas-saturated;

9                   (c) decompressing the exposed polymeric article and separating the article  
10 from the gas channeling means;

11                  (d) foaming the exposed article at a temperature below the melt temperature of  
12 the polymeric material; and

13                  (e) trimming the foamed article to produce finished foamed polymeric material  
14 and scrap solid state process foamed polymer,  
15 whereby the foamed polymer comprises PET crystallized to 19-35% at least on its  
16 surface.

1       17. A container produced by a method of thermoforming polymeric enabling deep  
2 draw and high definition, comprising the steps of:

3                 (a) interleaving an article of raw polymeric material with a gas channeling  
4       means;

5                 (b) exposing the interleaved article at elevated pressure to a plasticizing gas  
6       which is soluble in the polymer for a time sufficient to achieve a desired concentration  
7       of gas within the polymer, thereby forming an exposed polymeric article which is at  
8       least partially gas-saturated;

9                 (c) decompressing the exposed polymeric article and separating the article  
10      from the gas channeling means; and

11                 (d) thermoforming a container from the at least partially gas-saturated  
12      polymeric article.

1       18. A container produced by the method according to claim 17, further comprising  
2       foaming the article prior to thermoforming.

1       19. A container produced by the method according to claim 18, wherein the article is  
2       foamed by achieving a suitable concentration of gas within the polymer while  
3       exposing it and by heating the article after decompressing it to a temperature equal to  
4       or above the glass transition temperature of the exposed article.

1       20. A container produced by the method according to claim 19, wherein the  
2       temperature to which the article is heated after decompressing it is below the glass  
3       transition temperature for the unexposed polymer.

1       21. A container produced by the method according to claim 19, wherein the article is  
2       heated to a temperature equal to or above the glass transition temperature and below  
3       the melt temperature of the exposed article.

1       22. A container produced by the method according to claim 17, wherein  
2       thermoforming comprises heating the article to a temperature between its glass  
3       transition temperature and its melting temperature.

1    23. A container produced by the method according to claim 22, wherein the  
2    thermoforming temperature is closer to the glass transition temperature than to the  
3    melting temperature of the raw polymeric material.

1    24. A container produced by the method according to claim 17, wherein the article is  
2    foamed when it is thermoformed.

1    25. A container produced by the method according to claim 17, wherein the article is  
2    thermoformed without heating.

1    26. A container comprising an object produced by a method of forming unfoamed  
2    polymeric objects enabling high definition and deep draw, comprising:

- 3                 (a) interleaving an article of raw polymeric material with a gas channeling  
4    means;
- 5                 (b) exposing the interleaved article at elevated pressure to a plasticizing gas  
6    which is soluble in the polymer for a time sufficient to achieve a desired concentration  
7    of gas within the polymer, thereby forming an exposed polymeric article which is at  
8    least partially gas-saturated;
- 9                 (c) separating the article from the gas channeling means;
- 10                (d) thermoforming the object from the at least partially gas-saturated  
11    polymeric article while under pressure; and
- 12                (e) decompressing the formed object and letting it desorb the plasticizing gas.

1    26. A container produced by the method of claim 25, wherein the step of forming the  
2    object is performed without applying additional heat to the gas-saturated polymeric  
3    article.

1    27. A container produced by the method of claim 26, wherein the article has two sides  
2    and the object is formed by using pressure differences between the two sides of the  
3    article.

1    28. A container produced by the method of claim 26, wherein the object is formed  
2    using mechanical means.

1    29. A container produced by the method of claim 26, wherein the object is formed  
2    using pressure.

1    30. A container produced by the method of claim 26, wherein the object is formed  
2    using mechanical means to force the article into the desired shape of the object.

1    31. A container produced by the method of claim 25, wherein the article comprises  
2    previously foamed polymer.

1    32. A container of thermoformed foamed polymer having wall angles of less than 35  
2    degrees from vertical.

1    33. A container of thermoformed foamed polymer with a depth to width ratio  
2    exceeding 1:1.

1    34. A thermoformed foamed polymer cup.

1    35. A cup according to claim 34, further comprising a highly crystallized skin,  
2    whereby the cup is shape stable at temperatures exceeding 100 deg. C.

1    36. A cup according to claim 34, further comprising highly foamed crystallized PET  
2    throughout.

1    37. A container comprising an object produced by a method of forming unfoamed  
2    polymeric material, comprising the steps:

3                 (a) interleaving an article of raw polymeric material with a gas channeling  
4    means;

5                 (b) exposing the interleaved article at elevated pressure to a plasticizing gas  
6    which is soluble in the polymer for a time sufficient to achieve a desired concentration

7       of gas within the polymer, thereby forming an exposed polymeric article which is at  
8       least partially gas-saturated;

9               (c) decompressing the exposed polymeric article and separating the article  
10      from the gas channeling means;

11               (d) foaming the exposed article at a temperature below the melt temperature of  
12      the polymeric material;

13               (e) trimming the foamed article to produce finished foamed polymeric material  
14      and scrap solid state process foamed polymer; and

15               (f) forming the object,  
16      whereby the object comprises PET crystallized to 19-35%.